Cruzane Mountain Environmental Assessment

Fire and Fuels Report

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AFFECTED ENVIRONMENT

Forest Plan Direction and Regulatory Framework for Fire and Fuels

Forest Plan Direction and SWMZ's

The Lolo National Forest Plan (1986) provides guidance and standards for all natural resource management activities on the Lolo National Forest. The Forest land base is divided into 28 management areas (MA) that have different management goals, resource potentials and limitations. The MAs that correspond to the Cruzane Mountain proposed fuels treatments contain a standard for prescribed fire and wildland fire. The current Forest Plan direction calls for appropriate suppression strategies and allows for the use of prescribed fire to attain a variety of resource objectives. All proposed fuels treatments within the project area are in MAs that allow the use of prescribed fire. Specifically, prescribed burning may be planned and executed to maintain or restore the composition and structure of plant communities, or for hazard reduction purposes. The Lolo National Forest Plan provides guidance for the management of wildfire, prescribed fire, air quality and smoke management, and other fuel treatment methods.

In 2015/2016 the Lolo National Forest and the Fire Modeling Institute joined a partnership to collectively analyze wildfire risk across the forest. Four Strategic Wildfire Management Zones, or SWMZ's, were created through this process. SWMZ 1, Community Wildfire Protection, identifies areas with the highest risk to communities and community assets, concentrated human habitation, major infrastructure and high use recreational areas. SWMZ 2, General Wildfire Protection, identifies areas with high risk to communities and assets as well as natural resources that would see a negative impact from wildfire including major infrastructure, watershed, critical habitat, timber values, recreational infrastructure and ecological structure and function. SWMZ 3, Restoration, identifies areas with low to moderate risk to mostly natural resource values. The role of wildfire to meet resource objectives can be considered commensurate with the values at risk.

Regulatory Framework

Forest Service Manual 2500- Watershed and Air Management Chapter 2580 of this directive provides direction and policy regarding air quality and incorporates the Clean Air Act and amendments (42 U.S.C. 7401 et seq.).

Forest Service Manual 5130- Wildland Fire Suppression This directive's objective is "safely suppress wildfires at minimum cost consistent with land and resource management objectives and fire management direction as stated in Fire Management Plans" (FSM 5120; FSH 5109.17).

Forest Service Manual 5140- Fire Use This directive includes the deliberate application of fire to wildlands by resource managers (prescribed fire) and managing unplanned ignitions for resource benefit. It requires that a detailed burn plan be prepared for each planned ignition. This plan describes burn objectives, quantifies acceptable results, assesses risk, and provides acceptable parameters for ignition.

Forest Service Handbook 5109.19- Fire Management Analysis and Planning Handbook This directive provides the operational parameters whereby fire managers implement the goals and objectives in the Forest land and resource management plan or land management decisions.

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Title 17, Chapter 8, Subchapter 6 of the Administrative Rules of Montana (ARM) In compliance with ARM 17.8.610, the Forest Service obtains a major open burning permit annually from the State and agrees to utilize Best Available Control Technology (as defined in ARM 17.8.601(1)) and observe the provisions of the open burning permit.

Analysis Area Boundary for Fire and Fuels

The fire and fuels analysis will use the Cruzane Mountain project area boundary because this is the area where proposed activities would affect fuel conditions. The project area is 3,790 acres encompassing the entire Cruzane Mountain north of Interstate 90 and small portions north of road 288. The major drainages are Packer Creek, McManus Creek and Cruzane Gulch. Secondary ridges, gulches, intermittent creeks, ephemeral draws, aspect changes, and steep ground provide a large amount of diversity in the landscape.

Existing Condition

General Description and Fire History:

The community of Saltese sits on the west side of the project area and the community of Haugan sits on the east side of the project area. The Mineral County Community Wildfire Protection Plan (CWPP) identified the communities of Saltese and Haugan as "Priority At-Risk Communities." Along with this, the CWPP also identified as a high priority the need to: target fuels treatments in and adjacent to priority at-risk communities, to evaluate keeping roads open for ongoing forest management and fire response, and to reduce fuel loads on County roads accessing residential areas. In addition, the Lolo NF uses Strategic Wildfire Management Zones (SWMZ) to identify wildfire risk. SWMZ #1, Community Wildfire Protection, identifies areas with the highest risk to communities and community assets, concentrated human habitation, major infrastructure and high use recreational areas. SWMZ 1 makes up 100% of the Cruzane Mountain project area and all fire starts within SWMZ 1 will be a major threat to high values at risk.

The Cruzane Mountain project area has had nearly a century of aggressive full suppression tactics of all wildland fires, and as a result, the natural disturbance process of fire has largely been excluded from a majority of the acres. It is also important to note that due to location, topographical features, fuel types, and values at risk all fire starts within and surrounding the project area, human or lightning, will be initial attacked with the response strategy of full suppression.

The Cruzane Mountain project area is a fire dependent ecosystem, meaning that fire is a natural part of the landscape. The last major fire disturbance in the project area was the fire of 1910 which burned 3,000 acres. Since that time less than 1% of the project area has burned in a wildfire. In the absence of fire, and with no major periodic disturbances other than very limited commercial harvest and one prescribed burn, the overstory tree canopies have begun to close in, surface fuel accumulations have increased, conifers have filled in underneath the overstory, and shrubs have become woody with limited forage value. When an unplanned fire is introduced into these landscapes during fire season (typically July thru mid-September) wildfires can burn too intensely for firefighters to control. Fire exclusion and vegetation development have

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resulted in increased surface fuel accumulations, dense understory vegetation, and closed tree canopies causing an increased likelihood of high severity stand replacement fires.

To more specifically define existing condition from a fire/fuels standpoint, the Cruzane Mountain project can be divided into three general areas. The first area is the mostly south facing slope above I-90 which rises from the valley bottom to the main Cruzane Mountain ridge. This south face is dominated by ponderosa pine, and in general is very hot, dry, and grassy with light to moderate fuel loads. Douglas-fir encroachment underneath the larger ponderosa pine trees have led to an abundant amount of ladder fuels. When a fire occurs, ladder fuels can allow the fire to climb into the crown of the overstory trees and large wildfires occur. Fire starts are common along Interstate 90 during fire season (usually July through mid-September) as well as lightning started fires. If a fire gets established low on this slope, rapid rates-of-spread can be expected.

The second area is the mostly north facing slope on the backside of the Cruzane Mountain ridge. The north slope has more mixed conifer stands dominated by Douglas-fir and larch. There are numerous secondary ridges, gulches, intermittent creeks, ephemeral draws, aspect changes, and steep ground which provide a large amount of diversity. Some stands are healthy, multi-storied with low fuel loadings; however, within many stands there has been no major periodic disturbances since the early 1900's and the overstory tree canopies have begun to close in, surface fuel accumulations have increased, conifers have filled in underneath the overstory, and shrubs have become woody with limited forage value. Fire starts are not as common in this area, but the occasional lightning started fire does occur. Because of the landscape diversity, fires can range from low to high severity.

The third area is the valley bottoms associated with the 288 road system. A large majority of this road is located on private property. The road runs next to Packer Creek and McManus Creek, therefore the vegetation tends to be that associated with riparian areas. Spruce, sub-alpine fir and lodgepole are the dominant overstory trees. Canopies are dense with little to no crown spacing. Fuel loads range from moderate to heavy. On an average year fuel moistures will be the highest in this area when compared to other areas within the project. Expected fire behavior would be an "all or nothing" situation, meaning that on an average year little to no fire behavior would be expected, however, on bad fire years when fuels are on the extremely dry side, conditions could produce extreme fire behavior.

Fire history for the local area indicates that large fires almost always occur during drought years, the "bad fire seasons", and that these drought years occur fairly regularly. In the past 25 years, 1988, 1994, 2000, 2003, 2007, 2012, 2015 and 2017 were years when the Lolo National Forest experienced most of its large fires. The large fires during these years all exhibited the pattern of intense, rapid growth with a general spread pattern from the southwest to the northeast or from west to east. This is because the prominent wind direction is out of the west. Very rarely is there a significant head-fire pushing to the east. Based on this, it is reasonable to expect that a large fire burning in, or into the project area will do so in a similar manner.

The Cruzane Mountain project has had 19 wildfires within and in the immediate vicinity since 1986. This averages out to roughly 1 fire every two years. Although this is not a significant

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amount of wildfires, it does demonstrate that fire starts, both human and natural, do occur within the area. This is not expected to change in the near future. Each summer the Superior RD will continue to get wildland fires, the Forest Service will likely continue to suppress fires within the project area (due to values at risk), and fuel loads will continue to increase.

Ecosystem Maintenance Burning (EMB):

Until 1985, the main use for broadcast burning in the project area was to dispose of logging slash. In the late 1980's, the Superior Ranger District began to regularly use prescribed fire designed with multiple objectives: to eliminate hazardous fuels, regenerate browse for big game winter range, and reduce conifer encroachment. In the spring of 1999, one prescribed burn totaling 552 acres was completed over the Cruzane Mountain south face. With this reintroduction of fire a portion of the surface fuels were consumed, shrubs were rejuvenated, many of the smaller trees were eliminated, and canopy closure was slightly reduced. Since then no other major disturbances have occurred with the area.

Past Timber Harvest

A variety of timber harvest, mainly in the 1960's and 1970's, occurred on approximately 1200 acres within the project area. Most of this harvest was focused on the south face and along the valley bottom, leaving the north face untouched. This left a patchwork of roads, a variety of timber types, and plantations of various sizes and ages. Most logging residue was disposed of by broadcast burning, burning of machine piles, or whole tree yarding. Regeneration of the stands, both natural and planting occurred. With over 30 years of growth, young trees have developed that are extremely dense. Surface fuels generally have higher fuel moistures because of the lack of sunlight reaching the ground. Fuels accumulation and hazard is highly variable.

Road Systems:

Interstate 90 runs the length of the project at the bottom of the south face along the southern boundary. Although this does provide access, it also increases the risk of human-caused fires. The Packer Creek road runs along the west and north boundary. It also provides access to the valley bottoms surrounding the project area. The majority of this road runs through private property, which decreases chances for human starts because of limited access to the general public. FS road 3831 is the only road that provides access to the center of the project. It is in poor condition and currently could not be used for fire engine access, although it is drivable by pickup and could provide ground access for firefighters. There is no road access to the majority of the north slope of Cruzane Mountain, which severely limits and reduces firefighter's response times to initial attack wildland fires.

Summary of Conditions:

The Cruzane Mountain south face, north face, and along road 288 are all in need of fuels treatments. Every year trees, brush and grass continue to grow and die, causing an ever-increasing fuel load. For centuries, wildfire has been nature's way of eliminating this fuel. The exclusion of fire (since 1910) allows fuel build-up to continue, unless management activities are used to eliminate fuel, or wildfire burns them. Eventually, fuel accumulations build to such an extent that fire suppression efforts fail, and large wildfires occur. This increasing build-up of fuel will continue unless active management is used to reduce the fuel or wildfire consumes the fuel.

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Private land ownership and residential development is located west, north and east of the project area with Interstate 90 running along the southern border. Typical winds for the area are generally out of the west and southwest which align with the local topography as winds tend to funnel down the St. Regis River and down Silver Creek. With the combination of local winds, steep slopes, and the south aspect along the I-90 face, any fire starts along the Cruzane south face could expect rapid fire growth towards the east and northeast. Any fire starts along the north face could expect fire growth upslope (mainly moving south) and to the east. Under the right circumstances, stand replacement fire could occur.

ENVIRONMENTAL CONSEQUENCES

Analysis Methods

The majority of fire and fuels reconnaissance was completed by Lorie Cotter (Assistant Fire Management Officer-Fuels) and Josh Stroot (Fuels Specialist). These individuals work in fire management at the Superior Ranger District (RD) and have a thorough background in fire and fuels. Field reconnaissance collected information for analyzing the effects of the proposed treatments. Data gathered includes fire behavior fuel models, canopy fuels conditions, surface fuels characteristics, and forest habitat types. Canopy fuels conditions focused on factors that may contribute to crown fire development, such as the amount of live and dead trees in the overstory and horizontal continuity. Surface fuels characteristics focused on factors that may contribute to crown fire development and/or surface fire behavior that may lead to suppression problems; increasing surface fuel loadings, increasing fuel bed depths, increasing horizontal continuity in surface fuels, increasing vertical arrangements of surface and ladder fuels, and associated changes in fuel moisture content.

There are three major components of the wildland fire environment: Fuels, Weather and Topography. Within each of these components there are several factors that influence fire behavior which can vary over both time and space.

Fuels:	**Weather:**	**Topography:**
○ Fuel loading	○ Precipitation	○ Elevation
○ Size and shape	○ Temperature	○ Position on Slope
○ Compactness	○ Relative humidity	○ Aspect
○ Horizontal continuity	○ Atmospheric Stability	○ Shape of the country
○ Vertical continuity	○ Wind direction & speed	○ Steepness of slope
○ Chemical content		
○ Fuel moisture		

Of these factors humans can only alter or attempt to control the fuels component, as weather and topography are unable to be manipulated. Therefore efforts are focused on the fuels component.

All proposed fuel treatments, both harvest and prescribed burning, are based on the following 4 goals:

1. *Increase the efficiencies of firefighters because wildfire starts, both human and natural, are inevitable.* Wildland fuel treatments can change fire behavior, which can increase the effectiveness of fire suppression, especially during initial attack, by slowing fire growth and limiting spotting {Finney and Cohen 2003}.

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2. *Lessen the chances for crown fire development.* Crown fires are often considered the primary threat to forest types and human values, and crown fires are the primary challenge for fire management {Graham et al. 2004}. Crown bulk density, which depends on both species composition and stand density, is the primary controlling factor of crown fire behavior {Graham et. al. 1999}. Conditions that are favorable for crown fire development include {Rothermel 1991}:
   - Dry fuels
   - Low humidity
   - High temperatures
   - Heavy accumulations of dead and down litter
   - Conifer reproduction and other ladder fuels
   - Steep slopes
   - Strong winds
   - Unstable atmosphere
   - Continuous canopy

   The infinite possible combinations of these variables at any given point in time make predicting and modeling crown fire occurrence difficult and uncertain at best. Enough is known to recognize the conditions that can lead to crown fire events, but not enough to accurately model them, or model how they will behave. This analysis will focus on current research and knowledge regarding fuel conditions that can initiate a crown fire, and conditions that can support it once it has begun.

3. *Reduce fire intensity and lessen the severity (effects) of wildfires.* Reducing surface fuel loads and reducing ladder fuels will lessen fireline intensity and flame lengths. The Fire Behavior Hauling Chart shown below represents tactical interpretations of flame lengths and how they correlate to fireline intensity.

Flame Length (ft)	Fireline Intensity (Btu/ft/s)	Interpretations
Under 4	Under 100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4-8	100-500	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8-11	500-1000	Fires may present serious control problems – torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11	Over 1000	Crowning, spotting, and major fire runs are probable. Control efforts at the head of fire are ineffective.

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Empirical evidence from other wildfires also supports the concept that forests treated with fire hazard reduction objectives, burn with less severity than adjacent untreated areas {Omi and Martinson, 2002}; {Pollet and Omi, 2002}.

4. *Improve firefighter ingress and egress.* Successful initial attack of wildfires depends on quick response by firefighters. Roads provide the quickest form of access to wildfires and can significantly influence fire behavior. Although fire boundaries are influenced by multiple factors, roads tend to have the largest influence of any single variable {Narayanaraj and Wimberly 2011}.

All four of these goals can be accomplished by manipulating fuels to reduce the fire hazard. Agee and Skinner (2005) summarized principles of fire hazard reduction in a table, reproduced below:

Table: Principles of Fire Hazard Reduction Treatments

Principle	Effect	Advantage	Concerns
Reduce surface fuels	Reduces potential flame length	Control easier; less torching	Surface disturbance is less with fire than other techniques
Increase height to live crown	Requires longer flame length to begin torching	Less torching	Opens understory; may allow surface wind to increase.
Decrease crown density	Makes tree-to-tree crown fire less probable	Reduces crown fire potential	Surface wind may increase and surface fuels become drier.
Keep big trees of resistant species	Less mortality for the same fire intensity	Generally restores historic structure	Less economical; may keep trees at risk of insect attack

Graham et al. (2004) adds "reduce continuity of the forest canopy" to the list of objective, quantifiable fuel treatment criteria (principles). Peterson et al. (2005) concurs that potentially effective techniques for reducing crown fire occurrence and severity are to reduce surface fuels, increase canopy base height, reduce canopy bulk density, and reduce forest continuity.

The Photo Guide for Appraising Downed Woody Fuels in Montana Forests {Fischer 1981} developed an adjective rating scale (shown below) for five different expressions of fire behavior. Rate of Spread, Intensity, Torching, Crowning and Resistance to Control ratings describe and quantify direct correlations between effected fire behavior as a result of fuels treatments.

Adjective Rating Scale	
Rate of Spread Nil – fire cannot sustain itself. Low – spread will be slow and discontinuous. Medium – uniform spread possible, but can be stopped by aggressive ground attack with hand tools. High – spread will be rapid; indirect attack on fire front may be required for control. Extreme – spread will be explosive; little chance of control until weather changes.	**Intensity** Nil – fire cannot sustain itself. Low – cool fire; very little hot spotting required for control. Medium – fire will burn hot in places; aggressive hot spotting with hand tools likely to be successful. High – too hot for sustained direct attack with hand tools; aerial tankers or large ground tanker [mechanized equipment] required to cool fire front. Extreme – direct attack not possible; air or ground tanker [mechanized equipment] attack likely to be ineffective.
Torching Nil – no chance of torching. Low – occasional tree may torch-out.	**Crowning** Nil – sustained spread in crowns will not occur. Low – sustained spread in crowns unlikely.

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Medium – pole-sized understory trees likely to torch-out. High – Most of understory and occasional overstory trees likely to torch-out. Extreme – entire stand likely to torch-out.	Medium – some crowning likely but will not be continuous. High – sustained crowning likely. Extreme – sustained crowning will occur.
Resistance to Control Nil – no physical impediments to line building and holding. Low – occasional tough spots but not enough to cause serious line building and holding problems. Medium – hand line construction will be difficult and slow, but dozers [mechanized equipment] can operate without serious problems. High – slow work for dozers [mechanized equipment], very difficult for hand crews; hand line holding will be difficult. Extreme – neither dozers [mechanized equipment] nor hand crews can effectively build and hold line.	

These 5 expressions, and how they correlate to fire behavior and effects using the Adjective Rating Scale will be used to analyze the Cruzane Mountain proposed fuel treatments.

To provide a straightforward comparison between alternatives, the following constants, derived from the Lolo West Fire Danger Pocket Card, will be used to provide a forthright evaluation between alternatives.

- Energy Release Component (ERC) of 55-63. This correlates with a "Very High" Fire Danger Rating. The ERC is derived using the National Fire Danger Rating System (NFDRS) and is used to communicate the fire danger.
- Relative Humidity of <25%
- Temperature of >80°
- 20' wind speed of >10 mph
- 1000 hr fuel moistures <12%

These are local thresholds used to describe conditions in which large fires historically occur.

The Cruzane Mountain project can be broken into three distinct areas to help focus fuels analysis.

1. Area 1, referred to as "South Slopes", will encompass the proposed Low Severity (LS) prescribed burns LS1-LS3, as well as the commercial harvest units 4-20, 27, 28, 30, 31, 57, 42 and 70.
2. Area 2, referred to as "North Slope", will encompass the commercial harvest units 1, 3, 21-25, 27, 29, 31, 43-54B, 56 and 68.
3. Area 3, referred to as "Valley Bottoms", will encompass the proposed Fuel Break (FB) units FB1 and FB2, the pre-commercial thin (PCT) units 58A, 58B, 59 and 69, and the commercial harvest units 60, 61, 62A-62D, 63, 64, 66 and 67.

Effects Common to All Alternatives

Fires on the Superior Ranger District range from the numerous small spot fires that occur annually, to fires affecting thousands of acres. In the Cruzane Mountain project area, lightning fires and human caused fires will continue to occur, as they have in the past. Within the project area, wildland fires will continue to be suppressed due to values at risk. During fire season, thunderstorms are common on the district. These thunderstorms produce frequent lightning strikes that often result in multiple ignitions. When the number of ignitions exceeds the capabilities of local initial attack resources, fires are managed, and resources are allocated, according to the following priorities:

1. Protection of human life;
2. Protection of communities;
3. Protection of structures;
4. Protection of natural resources.

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When initial attack suppression actions are unsuccessful, and resources are available, the District conducts extended attack operations on the fire. If resources are not available, or extended attack is not successful, and the fire grows beyond district capabilities, large wildland fire suppression operations are initiated, including the activation of an Incident Management Team, which assumes management of the event.

A large fire burning in or near the project area will have threats to private property and/or homes. As private development continues within the project area, the number of people and structures in the Wildland-Urban Interface (WUI) has increased. This trend is expected to continue. If sufficient firefighting resources are available, efforts will be made to suppress the fire before it reaches structures, using perimeter control (containing and controlling the edge of the fire) and confinement (taking advantage of terrain and natural conditions to stop the fire when perimeter control is unsafe for firefighters). If sufficient firefighting resources are not available, efforts will be focused on point protection (protecting high-value sites) and confinement. The potential for large fires has escalated in recent years, as a combination of factors – drought, fuel buildup, budget shortfalls, lack of resources and the development of the National Cohesive Wildland Fire Management Strategy – have contributed to an increase in the number of large fires.

The Superior Ranger District, in partnership with Mineral County, has active fire prevention and Firewise programs, designed to educate homeowners about wildland fire and teach methods to protect homes and property from wildfire. Information is regularly distributed through school programs, news articles, campground hosts, and an informational booth at the Mineral County Fair.

The Superior Ranger District has wildland fire protection responsibilities on 544,630 acres of forested area within the district boundary. This includes all federal, state and private ownership. During fire season (June- September), the District has 15-20 initial attack (IA) wildland firefighters available on any given day, with 3 wildland engines. With these IA resources, 3-6 fires can be staffed at a given point in time. Additional resources can be ordered as necessary, but during a busy fire season these orders may not be filled in a timely manner. Heavy air tankers, single engine air tankers (SEATs), and helicopters are often available for initial attack.

Around the project area, emergency services for structure protection are provided by the West End Rural Fire Department which has ~20 volunteers with an average response of 6-10 volunteers to an initial call. This could provide enough resources to perform structure protection on 3-4 structures. When additional assistance is required, a request for mutual aid can be made and additional available resources can respond.

Alternative 1: No Action

Direct and Indirect Effects

The No Action alternative allows existing fuel conditions and trends in the project area to continue without the proposed fuel treatments. Since fuel conditions tend to change gradually and current fuels conditions have been described in the "Existing Condition" section of this report, this analysis will focus on fuel conditions in 10+ years.

The Principles of Fire Hazard Reduction Treatments will be used, however, since no treatment will be done only the component will be referenced. Since the fuels environment is not stagnant, ratings will be

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based on the fact that over the next 10 years surface fuel loads will increase, height to live crown will decrease, crown density will increase, big trees of resilient species are at a greater threat of loss due to higher fire intensities, and continuity of forest canopy will increase. Using the components of the Principles of Fire Hazard Reduction Treatments and local threshold constants derived from the Lolo West Fire Danger Pocket Card, adjective ratings were applied to fire behavior effects with no fuels treatments within all three of the Cruzane Mountain project areas.

South Slopes -- no treatment 10+ years
(LS1-LS3 and harvest units 4-20, 27, 28, 30, 31, 57, 42 and 70)

		Rate of Spread	Intensity	Torching	Crowning	Resistance to control
Fire Hazard Components (Agee and Skinner 2005)	Surface fuels	High	Medium	High	Medium	High
	Height to live crown (ladder fuels)	High	Medium	High	Medium	High
	Crown density	High	Medium	High	Medium	High
	Big trees of resilient species	High	Medium	High	Medium	High
	Continuity of the forest canopy	High	Medium	High	Medium	High
SUMMARY 15 High Ratings, 10 Medium Ratings						

North Slope -- no treatment 10+ years
(harvest units 1, 3, 21-25, 27, 29, 31, 43-54B, 56 and 68)

		Rate of Spread	Intensity	Torching	Crowning	Resistance to control
Fire Hazard Components (Agee and Skinner 2005)	Surface fuels	High	Medium	Extreme	High	High
	Height to live crown (ladder fuels)	High	Medium	Extreme	High	High
	Crown density	High	Medium	Extreme	High	High
	Big trees of resilient species	High	Medium	Extreme	High	High
	Continuity of the forest canopy	High	Medium	Extreme	High	High
SUMMARY: 5 Extreme Ratings, 15 High Ratings, 5 Medium Ratings						

Valley Bottoms -- no treatment 10+ years
(FB1 and FB2, PCT units 58A, 58B, 59 and 69, harvest units 60, 61, 62A-62D, 63, 64, 66 and 67)

		Rate of Spread	Intensity	Torching	Crowning	Resistance to control
Fire Hazard Components (Agee and	Surface fuels	Medium	Medium	High	Medium	High
	Height to live crown (ladder fuels)	Medium	Medium	High	Medium	High
	Crown density	Medium	Medium	High	Medium	High

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	Big trees of resilient species	Medium	Medium	High	Medium	High
	Continuity of the forest canopy	Medium	Medium	High	Medium	High
SUMMARY: 10 High Ratings, 15 Medium Ratings						

Alternative 1: No Action Summary
With no action occurring in the project area, fuels conditions will continue to trend towards the following:

- The south slopes would continue to have increasing long-needle litter accumulations, poor winter range values due to dying woody shrubs, increasing conifer regeneration encroachment (ladder fuel development) and increasing crown closures that may provide ideal conditions for crown fire initiation.
- The north slope and the valley bottoms would continue to be affected by mountain pine beetle-caused mortality with standing dead trees continuing to fall, increasing surface fuel loadings, and encouraging tree regeneration. Mixed species stands would continue to mature with resulting dense stands, high fuel loadings and large amounts of ladder fuels. Crown density and continuity will continue to become even more dense and continuous.

Efficiencies of firefighters will not be increased. Initial attack of a wildland fire (line construction, holding, and mop-up) becomes more difficult when heavy fuel loadings are encountered, aerial fuels become involved with fire, and danger trees are present. Actions on large fires are only compounded by those same issues associated with initial attack. With no action occurring in the project area, suppression efforts should expect the following:

- Line construction will proceed slowly due to the amount of work required to construct an appropriate fuel break and fireline through continuous heavy surface fuels and tree regeneration. Aerial delivery of water or retardant will be less effective in cooling the fire because of the heavier fuels.
- Holding and burning out fireline will be difficult, and may be less successful due to the potential for spotting from torching trees and heavy fuel concentrations. Water will be less effective in supporting holding efforts because of the heavier fuels. Burnout operations will be higher risk due to increased potential for spotting from torching trees and long residency time of fire in heavy fuels.
- Mop-up to secure the fire from escape will take longer due to residency time of fire in the heavier fuels.

Chances for crown fire development will not be lessened. Heavy surface fuels and ladder fuels will facilitate torching and spotting. Options for backfiring or burnout will be limited. Where tree crowns are horizontally continuous, there may be crown fire runs that compromise the fireline and jeopardize personnel.

Fire intensity and severity will not be reduced. Overstory mortality will be high. Fireline intensity could preclude the use of direct attack by hand crews. There will be more snags and hazard trees that need to be felled for firefighter safety.

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Firefighter ingress and egress will not be improved. Limited access for firefighting personnel will make response times significantly longer. With no treatment along the existing road systems, and very limited road access to the project area, firefighter access and safety could become severely compromised.

Alternative 2: Proposed Action

Direct and Indirect Effects

The Proposed Action includes over 1500 acres of timber harvest. One of the main benefits of timber harvest is that it decreases crown bulk density and reduces the continuity of the forest canopy which can significantly reduce the chances for crown fire development. Crown bulk density, which depends on both species composition and stand density, is the primary controlling factor of crown fire behavior {Graham et. al., 1999}. Once harvest is complete, every acre harvested will receive a fuels treatment. The majority of the acres will receive an understory burn to reduce surface fuels. Cram et al. {2006} found that in ponderosa pine forests of New Mexico and Arizona, wildfire severity was reduced in all treated stands compared to untreated stands. Thinning followed by burning was most effective at reducing fire intensity, followed by piling and burning. Lopping and scattering slash had the least effect on reducing fire intensity. Omi et al. {2007} found wildfire severity was often reduced by treatments in Colorado, Arizona, California, Oregon, and Washington. Treatments that included reduction of surface fuels were generally effective, with or without treatment of canopy fuels, but thinning followed by slash treatments produced the most impressive reduction in fire intensity and severity.

Approximately 182 acres will receive grapple piling and burning of piles to treat the slash created from harvest operations. Grapple piling will be mainly focused on the valley bottoms where the slope is manageable by ground based equipment. Once treatments are complete hazardous fuel accumulations and logging slash will be greatly reduced.

The proposed action proposes over 1,161 acres of low severity prescribed burning shown as three separate burns labeled LS1, LS2 and LS3. The objectives of the proposed EMB's in low severity fire regimes are to restore ponderosa pine communities, reduce existing surface fuel accumulations, reduce existing ladder fuels, raise crown base heights, and improve winter range forage. Low Severity EMB's would primarily be low intensity surface fire with occasional passive crown fire ranging in size from 1-10 acres. The areas proposed for low severity EMB's were selected because the physical setting, vegetative conditions, and fuel complexes are conducive for low severity fire behavior and may provide opportunities for repeated prescribed burning entries.

The Fuel Break units (FB1 and FB2) propose slashing the understory and felling of all standing dead trees. Fuel will then be handpiled and burned. This would decrease the wildfire risk and wildfire intensities along the main ingress/egress for residents and firefighters. Fuel breaks done in advance of a large wildfire can also be less impactive to other resources because treatments would not be emergency in nature. No harvest of overstory trees is proposed and no mechanized equipment will be used because treatments are located in the riparian zone.

The Proposed Action will implement fuels treatments on the following number of acres displayed in the table below.

	LS Treatments	Fuel Break Treatments	Commercial Treatments with	Commercial Treatments with Grapple	PCT with Pile and Burn

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			Understory Burn	Pile and Burn	
Proposed Action	1,161 ac	15 ac	1,229 ac	182 ac	77 ac

The Proposed Action provides for the existing condition and trends to be modified with harvest, prescribed fire and fuel break treatments. Since treatment on over 3,000 acres will take years to complete, this analysis will focus on fuel conditions in 10+ years, which is the predicted time that all fuels treatments will be complete.

Using the Principles of Fire Hazard Reduction Treatments and local threshold constants derived from the Lolo West Fire Danger Pocket Card, adjective ratings were applied to fire behavior effects on completed fuels treatments within all three of the Cruzane Mountain project areas.

South Slopes Post-treatment, approximately 10+ years (LS1-LS3 and harvest units 4-20, 27, 28, 30, 31, 57, 42 and 70)						
		Rate of Spread	Intensity	Torching	Crowning	Resistance to control
Principles of Fire Hazard Reduction Treatments	Reduce surface fuels	Medium	Medium	Low	Low	Low
	Increase height to live crown (ladder fuels)	Medium	Low	Low	Low	Low
	Decrease crown density	Medium	Medium	Low	Low	Low
	Keep big trees of resilient species	Medium	Low	Low	Low	Low
	Reduce continuity of the forest canopy	Low	Low	Low	Low	Low
SUMMARY: 6 Medium Ratings, 18 Low Ratings						

North Slope Post-treatment, approximately 10+ years (harvest units 1, 3, 21-25, 27, 29, 31, 43-54B, 56 and 68)						
		Rate of Spread	Intensity	Torching	Crowning	Resistance to control
Principles of Fire Hazard Reduction Treatments	Reduce surface fuels	Medium	Medium	Low	Low	Medium
	Increase height to live crown (ladder fuels)	Low	Medium	Low	Low	Medium
	Decrease crown density	Medium	Medium	Low	Low	Medium
	Keep big trees of resilient species	Low	Medium	Low	Low	Medium
	Reduce continuity of	Low	Medium	Low	Low	Medium

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	the forest canopy					
SUMMARY: 12 Medium Ratings, 13 Low Ratings						

Valley Bottoms Post-treatment, approximately 10+ years (FB1 and FB2, PCT units 58A, 58B, 59 and 69, harvest units 60, 61, 62A-62D, 63, 64, 66 and 67)						
		Rate of Spread	Intensity	Torching	Crowning	Resistance to control
Principles of Fire Hazard Reduction Treatments	Reduce surface fuels	Low	Medium	Medium	Low	Medium
	Increase height to live crown (ladder fuels)	Low	Medium	Medium	Low	Medium
	Decrease crown density	Medium	Medium	Medium	Low	Medium
	Keep big trees of resilient species	Low	Medium	Medium	Low	Medium
	Reduce continuity of the forest canopy	Low	Medium	Medium	Low	Medium
SUMMARY: 11 Medium Ratings, 14 Low Ratings						

Action Alternative Summary

The following table provides a summary of the Adjective Rating totals for both no treatment and post-treatment on the 3 different areas of Cruzane Mountain. The table clearly shows that once fuels treatments (harvest and/or burning) are complete, Medium/High/Extreme fire behavior ratings will be shifted to the Low/Medium range.

		Adjective Rating Scale Totals				
		Nil	**Low**	**Medium**	**High**	**Extreme**
1,161 acres	**South Slopes – no treatment 10+ years**	**-**	**-**	**10**	**15**	**-**
	South Slopes -- Post-treatment approx. 10+ years	**-**	**18**	**6**	**-**	**-**
719 acres	**North Slope -- no treatment 10+ years**	**-**	**-**	**5**	**15**	**5**
	North Slope -- Post-treatment approx. 10+ years	**-**	**13**	**12**	**-**	**-**
292 acres	**Valley Bottoms -- no treatment 10+ years**	**-**	**-**	**15**	**10**	**-**
	Valley Bottoms -- Post- treatment approx. 10+ years	**-**	**14**	**11**	**-**	**-**

Proposed fuel treatments within the Cruzane Mountain project are considered active management using fire to reduce forest fuel levels, improve and maintain big game winter range, and as a disturbance

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process to modify vegetation to improve its resiliency to undesirable fire effects, which can result in conditions where a wildfire may have less detrimental consequences. They would provide the following conditions for the next 10-35+ years:

- The south slopes would reintroduce fire as a disturbance process and would be in line with the natural fire regimes. The existing surface fuel accumulations and existing ladder fuels would be reduced. Scorching the lower limbs of mid-story and overstory trees would raise crown base heights. Shrubs would be rejuvenated and improve winter range browse values.
- The north slopes would have fire reintroduced as a disturbance process. The existing surface fuel accumulations would be reduced, ladder fuels would be reduced and crown base heights would be raised. The harvest would break up the canopy continuity and create a mosaic of size and age classes.
- The valley bottom treatments that receive a prescribed burn would reintroduce fire as a disturbance process and would be in line with the natural fire regimes. The existing surface fuel accumulations and existing ladder fuels would be reduced. Scorching the lower limbs of mid-story and overstory trees would raise crown base heights. Shrubs would be rejuvenated and improve winter range browse values. The valley bottom treatments that do not receive a prescribed burn will have pile treatments designed to replace fire as a disturbance. Piling and burning cannot actually replicate all of the effects of fire therefore these areas would not specifically be moved towards natural fire regimes. However treatments would increase opportunities to gain tactical advantages for effective suppression and existing surface fuel accumulations and existing ladder fuels would be reduced.

Efficiencies of firefighters will be increased. Initial attack of a wildland fire (line construction, holding, and mop-up) would become less difficult with the light fuel loadings, less potential for aerial fuels to become involved with fire, and fewer danger trees present. Suppression actions on large fires would find tactical advantages because of the treatments and placement of treatment units. With the proposed treatments, suppression efforts would experience the following benefits for the next 10-35+ years:

- Line construction would proceed at a faster rate because less work would be required to construct an appropriate fuel break and fireline through light surface fuels and minimal tree regeneration. Aerial delivery of water or retardant would be more effective in cooling the fire because of the lighter fuel loadings. Areas would have fewer danger trees that need to be felled for firefighter safety.
- Holding would be less complicated and more successful due to the reduced potential for spotting from torching trees and limited fuel concentrations. Water would be more effective in supporting holding efforts because of the light fuels. Burnout operations would be lower risk due to reduced potential for spotting from torching trees and short residency time of fire in light fuels.
- Mop-up to secure the fire from escape would take less time due to short residency time of fire in the light fuels.

Chances for crown fire development will be lessened. Heavy surface fuels and ladder fuels will be significantly reduced thereby reducing torching which leads to crown fires. The horizontal continuity of tree crowns would be reduced, so there would be less potential for crown fire runs that compromise the fireline and jeopardize personnel.

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Fire intensity and severity will be reduced. Overstory mortality will be low because fire intensity should not be high enough to kill overstory trees. Flame lengths should be at the level firefighters can use direct attack by hand crews. There will be less snags and hazard trees that need to be felled for firefighter safety, which allows crews to move quicker.

Firefighter ingress and egress will be improved. Ingress/egress on existing road systems is a major consideration when initial attacking fires. Forest roads are a key factor influencing cessation of wildfires because they serve as fire breaks and provide access for fire suppression activities. With the proposed new road building and improvements to the existing road systems, firefighter access is greatly increased. Ingress and egress safety is also significantly improved. In addition, roads are commonly used for burnout and holding operations, consequently any work done near roads in advance of a wildfire improves the odds of successful operations.

The Proposed Action would not prevent a wildfire. It is not a guarantee that homes and property would not burn. Proposed treatments would not reduce the ignitability of structures. Cohen {2000} case studies indicate that a home's structural characteristics and its immediate surroundings determine a home's ignition potential in a WUI fire. Proposed treatments would not eliminate the threat to the community from a wildfire. What the Proposed Action will do is significantly reduce the chances of catastrophic wildfires within the project area, lessening the threat to the surrounding communities, and providing better opportunities for tactical advantages during suppression actions.

Cumulative Effects

There are many past, present, and reasonably foreseeable actions that have influenced, are influencing or will influence vegetation in the project area. When considering past projects, past wildfires, and the proposed action projects in the Cruzane Mountain project, the total acres to be treated are displayed in the table below.

	Wildfires from 1980-2019	Prescribed burning from 1980-2019	Proposed LS Prescribed Burning	Proposed FB treatments	Proposed Commercial Treatments with understory Rx	Proposed Commercial Treatments with Grapple Pile and Burn	Proposed Pre-Commercial Treatments with pile and burn	**Total Acres to be Treated**
No Action Alt	2 acres	552 acres	0	0	0	0	0	**554 acres**
Proposed Action	2 acres	552 acres	1,161 acres	15 acres	1,229 acres	182 acres	77 acres	**3,218 acres**

The long-term trend of vegetation development in the area shows increasing amounts of fuel as biomass continues to accumulate at many times the removal rate. Insects and disease have killed and continue to kill a large proportion of lodgepole pine and Douglas-fir within the project area, primarily at mid-and upper elevations. The resulting red-needled trees have high crown fire potential because the fine fuel is already dried out. After the needles fall, the crown fire potential is reduced. Within a few years, the trees start falling and generate heavy surface fuel loads. The understory develops due to increased light and moisture, increasing ladder fuels. Any large wildfires in the future will reduce biomass on the acres burned, but any area not burned will continue adding to the 100-plus years of growth and biomass

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accumulation. Disturbances from active management using prescribed fire and/or mechanical treatments would reduce the amount of biomass within the treatment areas.

Successful wildfire suppression has resulted in development of stand structures and densities that are not representative of natural historic levels, and are setting stands up for high severity stand-replacing wildfire on moist sites, and at higher than historical levels on drier sites that typically would have had repeated low severity wildfires. Any large wildfires in the future will alter stand structures and densities on the acres burned and severity may be uncharacteristic for the particular fire regime. Disturbances from active management using prescribed fire and/or mechanical treatments would alter stand structures and densities on the acres treated and severity should be typical for the particular fire regime.

All proposed harvest units within the Cruzane Mountain project will receive a post-harvest fuels treatment. Site-specific variations may occur, but the majority of the harvest units will receive a prescribed underburn. Those harvest units which do not receive an understory prescribed burn will have ground fuels and slash piled and burned. Once burning or pile and burning is complete the resulting timber stand will have significantly lower fuel loads, ladder fuels will be decreased or eliminated, live crowns heights will be raised, crown density will be decreased and canopy continuity will be decreased. Overall firefighter safety and efficiencies will be increased, chances for crown fire development will be decreased, and potential wildfire intensity and severity will be decreased.

In 1999 one prescribed burn, totaling 552 acres was completed within the project area on the south face above the I-90 corridor. Since 20 years have passed since the burn was competed, surface fuels have slowly started to accumulate and ladder fuels have developed. The area burned is classified as a fire regime group 1, meaning the natural fire occurrence can range from 0-35 years typically with a low severity fire. This area is once again ready for another entry of prescribed burning. Once complete, surface fuels will be reduced, ladder fuels will be reduced, and crown base heights will be increased so stands are more resilient to wildfire.

In the 1960's, 70's and 80's, 1212 acres of the project area was harvested or pre-commercial thinned. These areas have seen over 30 years of growth in the vegetation. This develops stands that are extremely dense. Surface fuels generally have higher fuel moistures because of the lack of sunlight. Expected fire behavior would be an "all or nothing" situation, meaning that on an average year little to no fire behavior would be expected, however, on bad fire years when fuels are on the extremely dry side conditions could produce extreme fire behavior. Once these stands develop into mature trees stocking levels will be high and pose a high risk for crown fire development.

Road construction has the direct effect of removing vegetation and therefore creating discontinuity of fuels. Indirectly, roads provide access for a variety of past and potential vegetation management projects that may or may not reduce fuel hazard. Roads can provide access that can both increase the risk of human-caused wildfire and increase the effectiveness of wildfire suppression.

Firewood cutting along open roads removes large woody fuel from the forest, resulting in decreased fire hazard in some areas with extensive mortality. When tops are left scattered on the ground, the fire hazard is increased in the surface fuel layers.

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Private land development in many cases has resulted in long-term reduction of fuels as land is cleared and maintained as lawns or irrigated fields.

Private land timber harvest had a great effect on reducing crown fire potential by reducing canopy continuity and bulk density, but often surface fuels were increased by choice of slash disposal method.

Possible Conflicts with Plans or Policies of Other Jurisdictions

The Proposed Action Alternative utilizes prescribed fire and pile burning that could have the potential to violate the Clean Air Act. This issue is addressed in the Air Quality Analysis report.

Mitigation

Prescribed fire and pile burning would follow the plans, policies, and consider the use of appropriate mitigation measures for smoke management as outlined in the Air Quality Analysis report.
An approved Prescribed Fire Plan would be completed and adhered to for prescribed fire operations and pile burning.

Consistency with Forest Plan Direction and other Laws and Regulations

The Cruzane Mountain project is consistent with the Lolo National Forest (LNF) Land and Resource Management Plan (LRMP) which provides guidance for all natural resource management activities and establishes management standards for the Lolo National Forest. The Cruzane Mountain project is also consistent with laws and regulations pertaining to fire management. The following Acts authorize fire management activities for the protection of National Forest System lands and resources:

- Organic Administration Act, Act of June 4, 1897 (16 U.S.C. 551). This act authorizes the Secretary of Agriculture to make provisions for the protection of National Forests against destruction by fire.
- Bankhead-Jones Farm Tenant Act, Act of July 22, 1937 (7 U.S.C. 1010, 1011). This act authorizes and directs the Secretary of Agriculture to develop a program of land conservation and land utilization to "assist in controlling soil erosion, reforestation, preserving natural resources, protecting fish and wildlife, . . . mitigating floods, . . . protecting the watersheds of navigable streams, and protecting the public lands."
- Wilderness Act, Act of September 3, 1964 (16 U.S.C. 1131, 1132). This act authorizes the Secretary of Agriculture to take such measures as may be necessary in the control of fire within designated wilderness.
- National Forest Management Act, Act of October 22, 1976 (16 U.S.C. 1600 et seq.). This act directs the Secretary of Agriculture to specify guidelines for land management plans to ensure protection of forest resources. Implementing regulations at Title 36, Part 219 of the Code of Federal Regulations (36 CFR 219.27) specify that consistent with the relative resource values involved, management prescriptions in forest plans must minimize serious or long-lasting hazards from wildfire.
- Clean Air Act, as amended (42 U.S.C. 7401 et seq.). This act provides for the protection and enhancement of the nation's air resources and applies to the application and management of prescribed fire.

The following additional authorities provide for Forest Service wildfire protection activities on other lands under appropriate circumstances:

- Economy Act of 1932, Act of June 30, 1932 (41 U.S.C. 686). This act provides for procurement of materials, supplies, equipment, work, or services from other federal agencies.

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- Granger-Thye Act, Act of April 24, 1950 (16 U.S.C. 572). This act authorizes expenditure of Forest Service funds to erect buildings, lookout towers, and other structures on land owned by states. It provides for the procurement and operation of aerial facilities and services for the protection and management of the national forests and other lands administered by the Forest Service.
- Reciprocal Fire Protection Act, Act of May 27, 1955 (42 U.S.C. 1856). This act authorizes reciprocal agreements with federal, state, and other wildland fire protection organizations.
- Wildfire Suppression Assistance Act, Act of April 7, 1989 (42 U.S.C. 1856). This act authorizes the Secretary of Agriculture to enter into agreements with fire organizations of foreign countries for assistance in wildfire protection.

LNF fire management direction is defined by the 1986 LNF LRMP and by the following policy documents.

- Forest Service Manual 5100 – Fire Management.
- Federal Wildland Fire Management Policy and Program Review (1995).
- Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide (1998).
- Review and Update of the 1995 Federal Wildland Fire Management Policy (2001).
- Protecting People and Sustaining Resources in Fire-Adapted Ecosystems, A Cohesive Strategy (2000).
- Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000 (also known as the National Fire Plan, 2001).
- A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment, 10-Year Comprehensive Strategy Implementation Plan (2002).
- Interagency Standards for Fire and Aviation Operations 2006.
- Forest Service Health & Safety Code Handbook.
- Thirtymile Hazard Abatement Plan (2003).
- Northern Rockies Fire Doctrine

Monitoring Plans/Requirements

An approved Prescribed Fire Plan would be written for all prescribed burning. These plans will define the acceptable range of measurable criteria for environmental conditions and fire behavior. Prior to ignition, fuel moistures and weather conditions will be monitored to ensure they are within acceptable limits. During ignition, weather conditions, smoke dispersion, and fire behavior parameters would be monitored to ensure they are within acceptable limits. Post-burn monitoring would be completed on all burns to determine if objectives, as outlined in the Prescribed Fire Plan, are met. Post-burn monitoring would be accomplished through general observation and recorded in the prescribed fire plan.

Probable Environmental Effects that Cannot be Avoided

Prescribed burning would generate smoke for a short duration. Air quality predictions and restrictions issued by the Montana/Idaho State Airshed Group's Smoke Monitoring Unit would be observed. No significant effects are expected from the temporary reduction in air quality.

Prescribed fire and mechanical fuels treatments would reduce fuel loadings resulting in a change in fire effects within treated areas, and possibly adjacent untreated areas. Mechanical fuels treatments would alter the amount of plant biomass converted by wildland fire to smoke and nutrients. Mechanical fuels treatments would alter the amount of energy released by wildland fire to injure or kill plant tissue and

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cause secondary chemical reactions. Please refer to the Cruzane Mountain Air Quality Report for a more detailed look at air quality analysis.

Relationship between Short-term and Long-term Productivity
N/A

Irreversible and Irretrievable Commitments of the Resource
There will be no irreversible or irretrievable commitments of air quality due to the short duration of smoke production during prescribed fire activities.

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SUPPORTING DOCUMENTS IN PROJECT FILE:

FireHistory.pdf – map displaying all documented wildfires from 1910 to present day.

CumulativeEffects.pdf – map displaying past harvest burns and past Ecosystem Maintenance Burns from 1980 to present day and also shows units currently authorized for treatment and awaiting implementation.

20yrSuperiorRxHistory.xlsx -- excel spreadsheet listing all prescribed fire units, both harvest and EMB's burned on the Superior Ranger District since 1985.

CruzaneFireHistory.xlsx – excel spreadsheet showing all wildfires within and surrounding the project since 1910.

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